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Lohmannella and *Simognathus* (Halacaridae: Acari) from Western Australia: description of two new species and reflections on the distribution of these genera

Ilse Bartsch

Deutsches Zentrum für Marine Biodiversitätsforschung, Forschungsinstitut Senckenberg, Notkestr. 85, 22607 Hamburg, Germany, e-mail: bartsch@meeresforschung.de

Abstract – Two new littoral species, *Lohmannella septemsetosa* sp. nov. and *Simognathus cruciferus* sp. nov. are described and the description of *L. pinggi* Otto, 1994 is supplemented. The genera *Lohmannella* and *Simognathus* are distributed world-wide. More species are recorded from the southern than northern hemisphere. *Lohmannella* is abundant in warm-temperate to polar regions but rare in the tropics. In contrast, most records of *Simognathus* are from tropical and warm-temperate areas. According to external morphological characters and distribution, different lineages of *Lohmannella* species developed in the north and south. *Simognathus* demonstrates no such north-south discrimination.

INTRODUCTION

The two genera *Lohmannella* and *Simognathus* include 35 and 43 species and subspecies, respectively (to the end of 2004). Representatives of both are distributed world-wide, but there is a distinct difference between the faunas of the northern and southern hemisphere. *Simognathus* is more diverse in the south than in the north (Bartsch 1994, 2004). More marine *Lohmannella* species are recorded from the southern than northern hemisphere, though locally species diversity is high in the north, too. Both genera are present in Western Australia. One *Lohmannella* species has been described from Rottnest Island, off Perth (Bartsch 1993b). A record of another species and the description of a new species, from Esperance, will be presented in this paper. Ten *Simognathus* species are already known to belong to the Western Australian fauna (Bartsch 1993b, 1994, 2003b), and a new species from Esperance is described below.

MATERIAL AND METHODS

The material studied was collected during Marine Biological Workshops held in Western Australia, on Rottnest Island and in Esperance. The fauna and flora around Rottnest Island is dominated by warm-temperate species, although strongly influenced by tropical elements (Wells and Walker 1993). Esperance lies within the warm-temperate zone (Knox 1963; Wilson and Allen 1987; Ponder and Wells 1998; O'Hara and Poore 2000).

The material was collected by the author. The mites were cleared in lactic acid and mounted in glycerine jelly. Slides with holotypes and voucher specimens are deposited in the Western Australian Museum, Perth (WAM), apart from one *Lohmannella* specimen in the Zoological Institute and Museum in Hamburg (ZMH).

Abbreviations used in the descriptions are as follows: AD, anterior dorsal plate; AE, anterior epimeral plate; ds-1 to ds-5, first to fifth pair of dorsal setae numbered from anterior backward; GA, genitoanal plate; glp-1 to glp-5, pair of gland pores numbered 1 to 5 from anterior backward; GO, genital opening; GP, genital plate; OC, ocular plate(s); P-2 to P-4, second to fourth palpal segment; pas, parambulacral seta(e); PD, posterior dorsal plate; PE, posterior epimeral plate(s); pgs, perigenital setae; sgs, subgenital setae. The legs, their segments and claws are numbered I to IV. The leg segments 1 to 6 are trochanter, basifemur, telofemur, genu, tibia, and tarsus. The setation formula of the legs is presenting the number of setae from trochanter to tarsus.

The position of a seta is given in a decimal system, with reference to the length from anterior to posterior or basal to distal.

SYSTEMATICS

Family Halacaridae Murray, 1877

Subfamily Lohmannellinae Viets, 1927

Genus *Lohmannella* Trouessart, 1901

***Lohmannella septemsetosa* sp. nov.**
Figures 1A–K, 2A–F

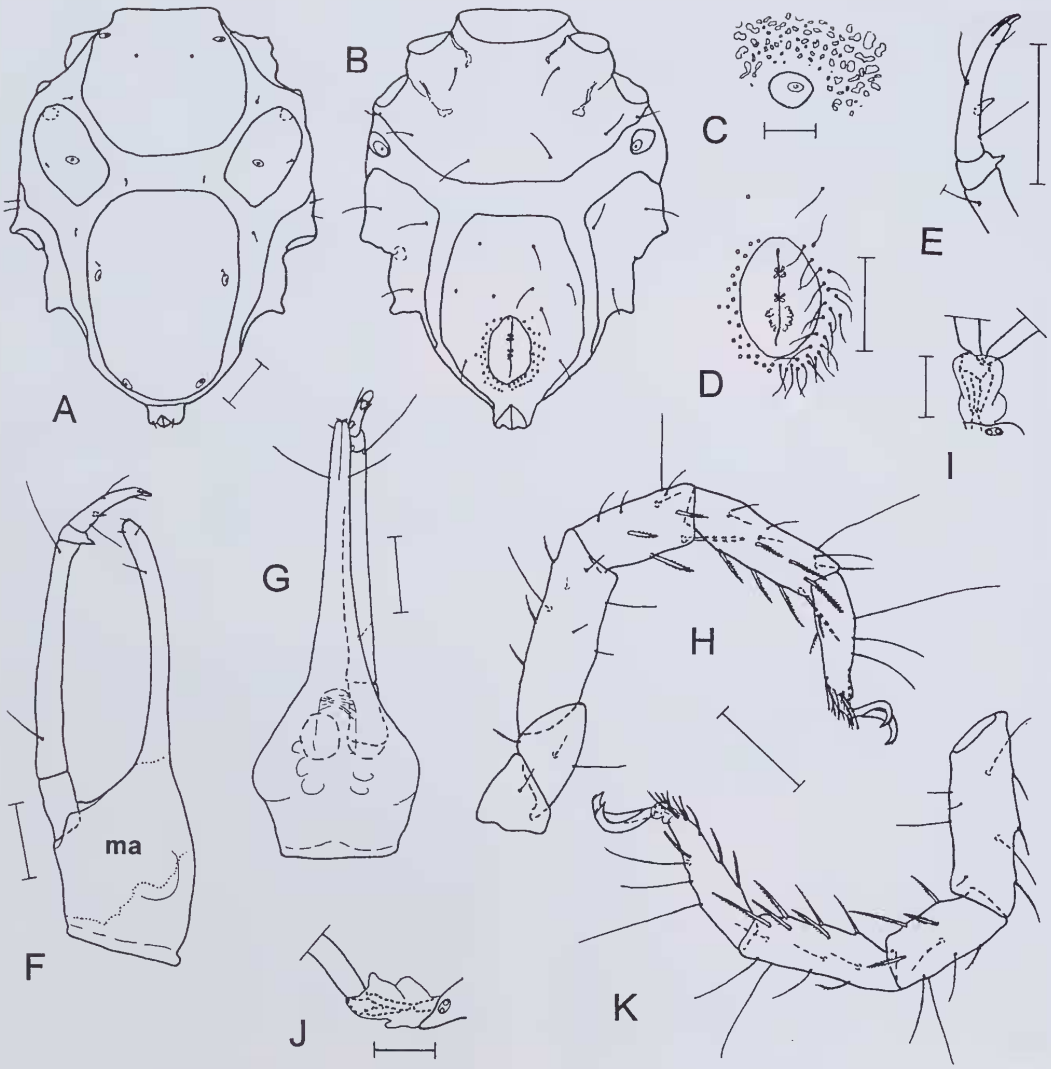

Figure 1 A–K. *Lohmannella septemsetosa* sp. nov., holotype male. A, Idiosoma, dorsal; B, idiosoma, ventral; C, part of OC with gland pore; D, genital opening; E, P-3 and P-4, lateral; F, gnathosoma, lateral (stippled area enclosing maze-like structured integument); G, gnathosoma, ventral; H, leg I, medial; I, ambulacrum of tarsus I, ventral; J, ambulacrum of tarsus II, medial; K, telofemur to tarsus II, medial. (ma, area with maze-like epicuticula). A, B, D–H, K: scale = 50 µm; C, I, J: scale = 10 µm.

Material Examined

Holotype

Male, Lucky Bay, Cape le Grand, 33°59'S, 122°13'E, near Esperance, Western Australia, Australia; algal tufts with sediment, 30 cm below water edge, 15 February 2003 (WAM T62841).

Paratype

One deutonymph, same data as for holotype (WAM T62842).

Diagnosis

Idiosomal length 410 µm, gnathosomal length 284 µm, ratio idiosoma:gnathosoma 0.69. Surface of plates with reticulate and maze-like ornamented epicuticula. Gland pores large. Pair of ds-1 posterior to level of gland pores. OC with gland pore in middle of plate. P-2 without spiniform ventral process. Genu and tibia I with four and seven bipectinate ventral setae. Tarsi I to IV with 2, 2, 3, 2 bipectinate ventral setae. Claws with accessory process.

Description

Male

Idiosoma. Length 410 µm, width 302 µm. Dorsal plates covered by delicately reticulate or maze-like epicuticula. Length of AD 142 µm, width 159 µm; pair of gland pores with wide, oblong alveolus, almost 10 µm in width (Figure 1C). Length of OC 102 µm, width 57 µm. Gland pore in middle of plate, pore canaliculus at the same level but in lateral margin (Figure 1A). A very faint, cornea-like structure near anterior margin. Length of PD 202 µm, width 150 µm, anterior margin truncate, with broadly rounded corners. With two pairs of large gland pores as illustrated. Pair of ds-1 (setae broken) posterior to the level of pair of gland pores. Following pairs of setae small; ds-2, ds-3 and ds-4 within striated integument, ds-5 immediately anterior to glp-4. Adanal setae on anal cone.

Ventral plates with maze-like or irregularly reticulate or foveate epicuticula. Length of AE 137 µm, width 269 µm. Pair of platelets between AE and PE, each platelet with large gland pore (Figure 1B). Length of PE 179 µm; each plate with two dorsal and three ventral setae. Length of GA 207 µm, width 144 µm; anterior margin truncate. Plate with about nine outlying setae and 52 setae close around GO (Figure 1D). Length of GO 63 µm, width 43 µm; distance between anterior margin of GO and that of GA equalling 1.5 times length of GO. Genital sclerites with four pairs of spurlike sgs. Three pairs of internal genital acetabula shining through genital sclerites.

Gnathosoma. Slender, length 284 µm, or 0.69 times of idiosomal length. Width of gnathosoma 107 µm, length:width ratio 1:0.27. Lateral flank of gnathosomal base with an area with maze-like ornamented epicuticula (Figure 1F). Pharyngeal plate far from reaching posterior margin of gnathosoma (Figure 1G). Rostrum slender, much

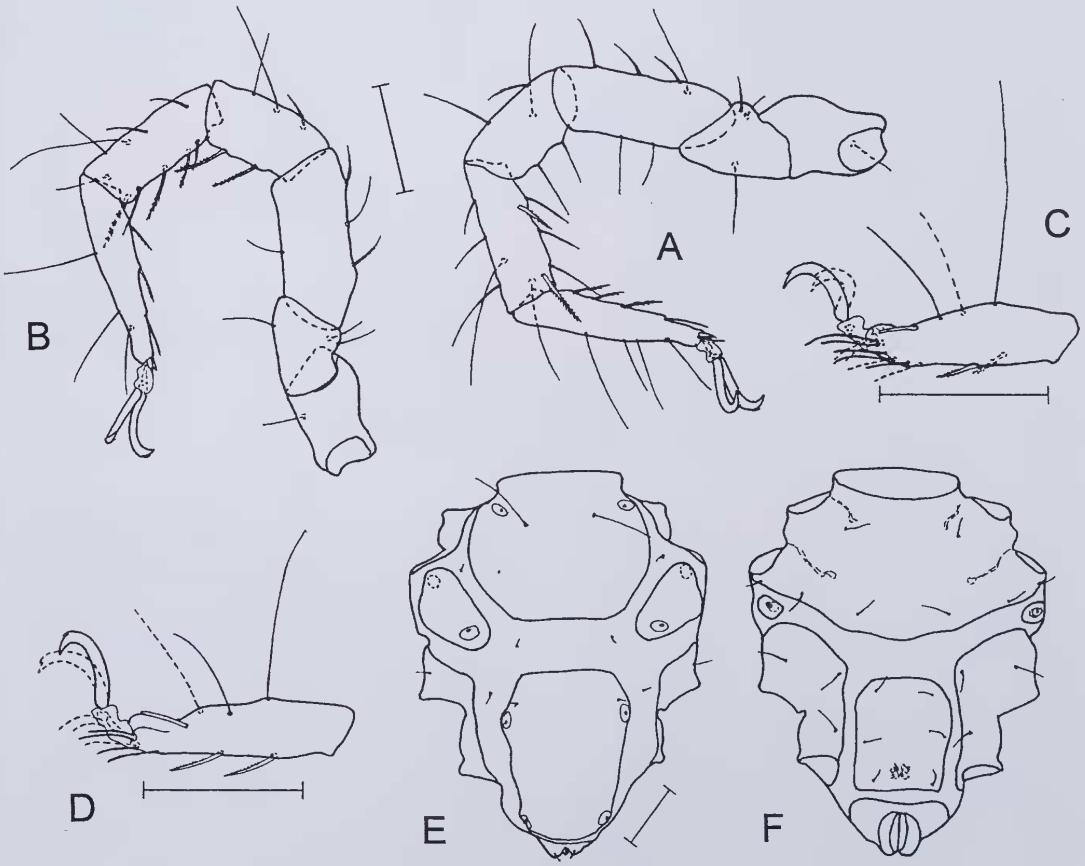

Figure 2 A–F. *Lohmannella septemsetosa* sp. nov. A, Leg III, medial, male; B, leg IV, medial, male; C, tarsus I, lateral, male (medial setae and claw in broken line); D, tarsus II, medial, male (lateral setae and claw in broken line); E, idiosoma, dorsal, deutonymph; F, idiosoma, ventral, deutonymph. Scale = 50 µm.

longer than gnathosomal base. Both pairs of maxillary setae short and situated in posterior quarter of rostrum. Palps slender. P-2 with two setae, basal setae near segment's base, at 0.2. P-3 with spur-like process (no spine). Basal portion of P-4 with two slender setae and one spur, apical portion with solenidion, small seta and spur-like tip (Figure 1E).

Legs. Slender, integument with maze-like sculpturing. Leg I slighly longer, leg IV shorter than idiosoma. Telofemur I about 3.4 times longer than high (Figure 1H). Leg chaetotaxy (pas excluded, solenidia included): leg I, 1, 3, 9, 9, 14, 11 (Figure 1H); leg II, 1, 3, 9, 9, 13, 9 (Figure 1K); leg III, 1, 3, 6, 5, 10, 8 (Figure 2A); leg IV, 1, 3, 4, 5, 10, 6 (Figure 2B). Several of short dorsal setae delicately serrate. Genua I to IV with 4, 4, 2, 2 ventral setae; setae of genua I, II and IV bipectinate. Tibiae I to IV with 7, 6, 5, 5 ventral setae; 7, 4, 2, 3 of these setae bipectinate. Tarsi I to IV with 4, 4, 4, 3 dorsal setae, solenidia included. Solenidion of tarsus I 11 µm in length and in dorsolateral position (Figure 2C); on tarsus II solenidion 14 µm in length and in dorsal position (Figure 2D). Tarsi I to IV with 2, 2, 3, 2 bipectinate ventral setae and 5, 3, 1, 1 slender setae. Tarsus I with pair of doubled pas; tarsus II with medial pas doubled, lateral pas single; tarsus III with spiniform lateral pas and a seti- plus a spiniform medial pas; pair of pas of tarsus IV spiniform.

Claws with accessory process. Central sclerite small, without claw-like process. All tarsi with carpite between end of tarsi and claws (Figure 1I and J). Carpite divaricate, 9 µm in length.

Deutonymph

Idiosomal length 290 µm. Shape of AD similar to that of male. OC shorter; pair of gland pores close to posterior corner of plate (Figure 2E). PD shorter and more narrow than that plate of male. AE with four pairs of setae (Figure 2F); PE with one dorsal and three ventral setae. GP and anal plate separated. GP with three pairs of pgs and two pairs of minute, seta-like sgs. Length of gnathosoma 116 µm, i.e. 0.80 of idiosomal length. Leg chaetotaxy: leg I, 1, 3, 5–6, 5–6, 10, 9; leg II, 1, 3, 5–6, 6, 9, 7; leg III, 1, 3, 4, 4, 7, 6; leg IV, 1, 1, 2, 3, 6, 4, 4. Genu I with pair of bipectinate setae. On genu II ventromedial seta bipectinate, ventrolateral seta slender and very faintly pectinated. Ventral seta of genu III slender, that seta of genu IV bipectinate. Tibia I with two ventromedial and three ventrolateral setae, these five setae bipectinate. Tibia II with two pairs of bipectinate setae. Tibia III with one large bipectinate and one short, slightly pectinate seta, and tibia IV with two to three strong, bipectinate setae. Tarsi I–IV with 2, 2, 2, 1 bipectinate ventral setae and 3, 1, 0, 0 eupathid ventral setae.

Etymology

The specific name is derived from *septem* (Latin), seven, and *setosus* (Latin), with setae, as tibia I of this species bears seven ventral setae.

Remarks

The most conspicuous characters of *Lohmannella septemsetosa* are the gland pores with large alveoli and the seven bipectinate ventral setae on tibia I. A similar combination of characters is present in *L. dictyota* Bartsch, 1992, *L. gaussi* Lohmann, 1907, *L. kerguelensis* Lohmann, 1907, and *L. pinggi* Otto, 1994. Records of *L. dictyota* are from the southwestern Pacific, from the Society Islands, the Coral Sea and Great Barrier Reef (Bartsch 1992; Otto 2000). *L. pinggi* is known from Victoria and New South Wales, Australia (Otto 1994), *L. gaussi* from Antarctica and sub-Antarctica, from off Wilhelm II Land, the islands Crozet, Marion and South Sandwich (Lohmann 1907; Bartsch 1979a, 1993a; Newell 1984), and *L. kerguelensis* from the Kerguelen Islands and Palmer Archipelago (Lohmann 1907; Bartsch 1993a). *Lohmannella dictyota* has an unusual elongate PD with a prominent ornamentation, the ds-3 are situated on the PD, the pair of gland pores 2 are in the medial corners of the OC, and the P-2 has a spiniform ventral process. *Lohmannella gaussi* is, compared with congeners, large-sized, its legs and gnathosoma are long and slender; the glp-2 are near the lateral margin of the OC, and the PD bears a V-shaped porose area, characters not present in *L. septemsetosa*. In contrast to *L. septemsetosa* the OC of *L. kerguelensis* has a cornea and the ds-3 are in the anterior rounded margin of PD. *Lohmannella pinggi* has much shorter legs than *L. septemsetosa*, elongate OC and the ds-1 are situated distinctly anterior to the level of gland pore 1.

Lohmannella pinggi Otto, 1994
Figure 3A–G

Lohmannella pinggi Otto, 1994: 32–35, figures 1–8.

Material Examined

One female, Rottnest Island, Cape Vlamingh, ca 32°02'S, 115°27'E, Western Australia, Australia; from corallines on rocky platform, 10 January 1991 (WAM T62843). One female, Rottnest Island, Cape Vlamingh; from corallines on rocky platform, 9 January 1991 (WAM T62844). One female (damaged), Rottnest Island, Cape Vlamingh, Western Australia, Australia; from corallines on rocky platform, 9 January 1991 (ZMH).

Diagnosis

Idiosomal length 279–303 µm, gnathosomal length 192–197 µm. Dorsal plates delicately reticulated. OC oblong, its length more than twice the width. With five pairs of large gland pores; glp-

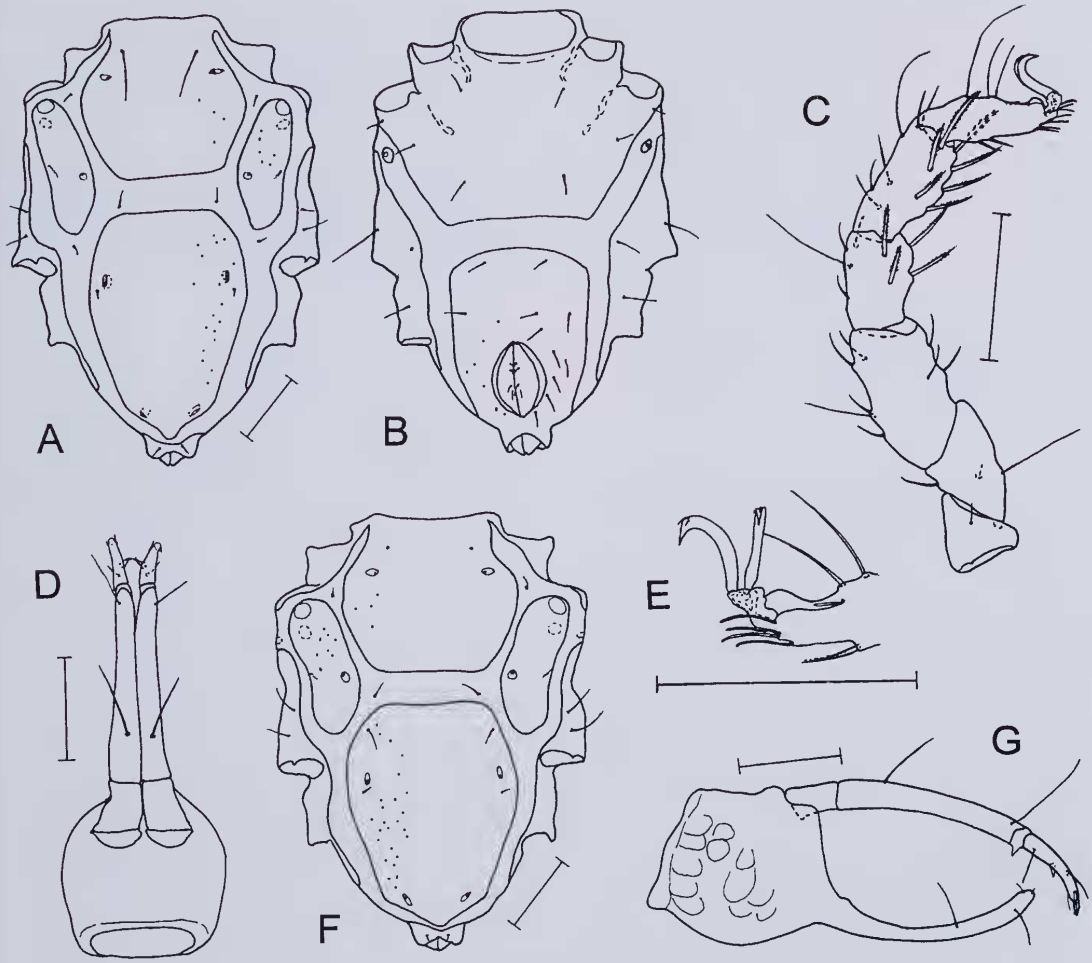

Figure 3 A–G. *Lohmannella pinggi* Otto, 1984, female. A, Idiosoma, dorsal; B, idiosoma, ventral; C, leg I, medial; D, gnathosoma, dorsal; E, tip of tarsus II, medial; F, idiosoma, dorsal, G, gnathosoma, lateral. Scale = 50 µm.

3 near medial margin of OC. Pair of ds-1 anterior to level of gland pores. Female GA with nine pairs of pgs. Gnathosoma 2.4 times longer than wide, length ratio idiosoma to gnathosoma 1:0.65. No ventral spiniform process on P-2. Basal seta of P-2 strong, situated in basal half. Genu I with two pairs of bipectinate setae; tibia I with seven such setae. Tarsi I to IV with 2, 2, 4, 2 bipectinate ventral setae. Accessory process of claws with minute tines.

Supplementary Description

Idiosomal length 279 and 303 µm, gnathosomal length 192 and 197 µm. Dorsal plates delicately reticulated and with scattered deep canaliculi (Figure 3A). OC oblong, length more than twice its width; anterior cornea distinct, posterior one faint. Gland pores distinct, their alveoli 7 µm in width; glp-2 in ventral position, glp-3 on OC near its medial margin, at about 0.57. Pair of ds-1 anterior to the level of gland pores. Two females (WAM T62843 and ZMH) with ds-2, ds-3 and ds-4 within striated integument (Figure 3A); ds-5 adjacent to glp-4. One female (WAM T62844) with pair of ds-4 situated on PD (Figure 3F). PE long, extending anteriad beyond middle of OC. Female with 18 pgs. Interval between anterior margin of GA and GO equalling 1.1 times the length of the latter. Gnathosomal length 192 and 197 µm, i.e., 0.65–0.69 of idiosomal length. P-2 without ventral process (Figure 3G); its basal seta situated at 0.22 (Figure 3D). Legs short. Genua and tibiae with articular membranes; tarsi with small fossa membranes. Length:height ratio of telofemora I and II 2.0, that of telofemora III and IV 1.6. Leg chaetotaxy (solenidia included, pas excluded): leg I, 1, 3, 8, 8, 13, 10; leg II, 1, 3, 8, 8, 12, 9; leg III, 1, 3,

6, 4–5, 9, 8; leg IV, 1, 3, 4, 4, 8, 5–6. Number of bipectinate ventral setae of genua I to IV: 4, 2, 0, 1; of tibia I to IV: 7, 3, 1, 4 (one of the latter slender); of tarsi 1 to IV: 2, 2, 4, 2. Tarsus 1 with four dorsal setae (solenidion included), two bipectinate ventral setae, two pairs of ventral eupathia and a pair of pas (Figure 3E); lateral pas doubled. Tarsus II with four dorsal setae, three ventral eupathidia and pair of pas; lateral pas doubled. Tarsus III with four dorsal setae and pair of pas, lateral pas setiform, medial pas including both a seti- and spiniform seta. Tarsus IV with three dorsal setae, none or one smooth ventral seta and pair of spiniform pas. Accessory process of claws with two tines (Figure 3E).

Remarks

Three females were taken amongst shallow water corallines, of which two agree almost perfectly with the description of *L. pinggi* by Otto (1994). Differences are: the somewhat smaller size (303 µm vs 378–437 µm), shape of ds-1 (long and slender vs spiniform), number of corneae (two vs one), presence of the ds-5 (vs absence), number of setae on AE (four vs three pairs) and number of dorsal setae of the legs. The five last mentioned differences are thought to be due to either a range of great variability in the type series or inadequate description; the difference in size may partly be due to the mounting.

One of the present females has the ds-4 inserted on the PD instead, as usual, within the striated integument posterior to the OC. Apart from this character, that female agrees with the other specimens. In most of the *Lohmannella* species the ds-2, ds-3 and ds-4 are situated on tiny sclerites within the striated integument; intraspecific variations, if present at all, are expected to be within a very limited range. The ds-2 in general are between the AD and OC, in some few species the ds-2 are in or on the lateral margin of the AD. The ds-3 are anterior to the PD, in ten species the setae are in the margin or on the PD; the ds-4 are inserted immediately posterior to the OC; one exception is *L. multispina* Newell, 1984 where the setae are found in the corner of the OC, other exceptions are the freshwater species, i.e., *L. andrei* (Angelier, 1951), *L. heptapegoni* Petrova, 1966, *L. curvimandibulata* (Petrova, 1969), *L. cvetkovi* (Petrova, 1965), and *L. stammeri* Viets, 1939. In these species both the ds-4 and ds-5 are inserted on the PD. These five species live in nearshore and continental waters in countries around the Mediterranean (Bartsch 1996; Pesic 2004).

Subfamily Simognathinae Viets, 1927

Genus *Simognathus* Trouessart, 1889

Simognathus cruciferus sp. nov.

Figure 4A–L

Material Examined

Holotype

Female, Duke of Orleans Bay, ca 33°55′S, 122°35′E, near Esperance, Western Australia, Australia; demosponge overgrown with green algae and corallines, just below water line, 17 February 2003 (WAM T62845).

Diagnosis

Idiosomal length 375 µm. Dorsal plates colourless, almost uniformly foveate and with numerous delicate canaliculi. AD and OC with cornea-like structures. OC almost triangular. Pair of ds-4 on PD. Adanal setae in ventral position. AE with marginal areolae with foveae and canaliculi, integument in a cross-shaped median area almost smooth. GA with such smooth integument in a T-shaped area. Anterior margin of female GA arched. P-2 with ventral protuberance and bristle. Tibia I with wide but short, bluntly ending spine.

Description

Female

Idiosoma. Length 375 µm, width 200 µm. Dorsal plates almost uniformly foveate (Figure 4A), each fovea surrounded by delicate canaliculi. All plates colourless. Length of AD 157 µm, width 97 µm; its posterior margin truncate. First pair of gland pores small, slightly posterior to the level of insertion of leg I. An ovate smooth area near anterior margin. Length of OC 40 µm, width 24 µm, with ovate cornea. Length of PD 165 µm, width 95 µm, 1.7 times longer than wide. Dorsal setae small. Pair of ds-1 on AD close to pair of gland pores. Pair of ds-2 within striated integument immediately anterior to OC. Pair of ds-3 in distolateral corners of AD; ds-4 and ds-5 on PD; adanal setae on anal cone, in ventral position.

AE marginally foveate but smooth immediately posterior to insertion of legs I and II and in a ventral cross-shaped area (Figure 4B). Foveae surrounded by delicate canaliculi. Two pairs of internal scars (muscle attachment) in middle of cruciform area. Length of AE 142 µm, width 199 µm; epimeral processes 1 large, slightly raised, epimeral vesicles large, with three pairs of ventral setae, posteriormost pair only slightly posterior to second pair of setae. Length of PE 177 µm. Length of GA 155 µm, width 108 µm, integument in a T-shaped area almost smooth, remainder foveate. Length of GO 43 µm, width 25 µm; distance between anterior margin of GO and that of GA 1.7 times length of GO. With four pairs of pgs on either side of GO.

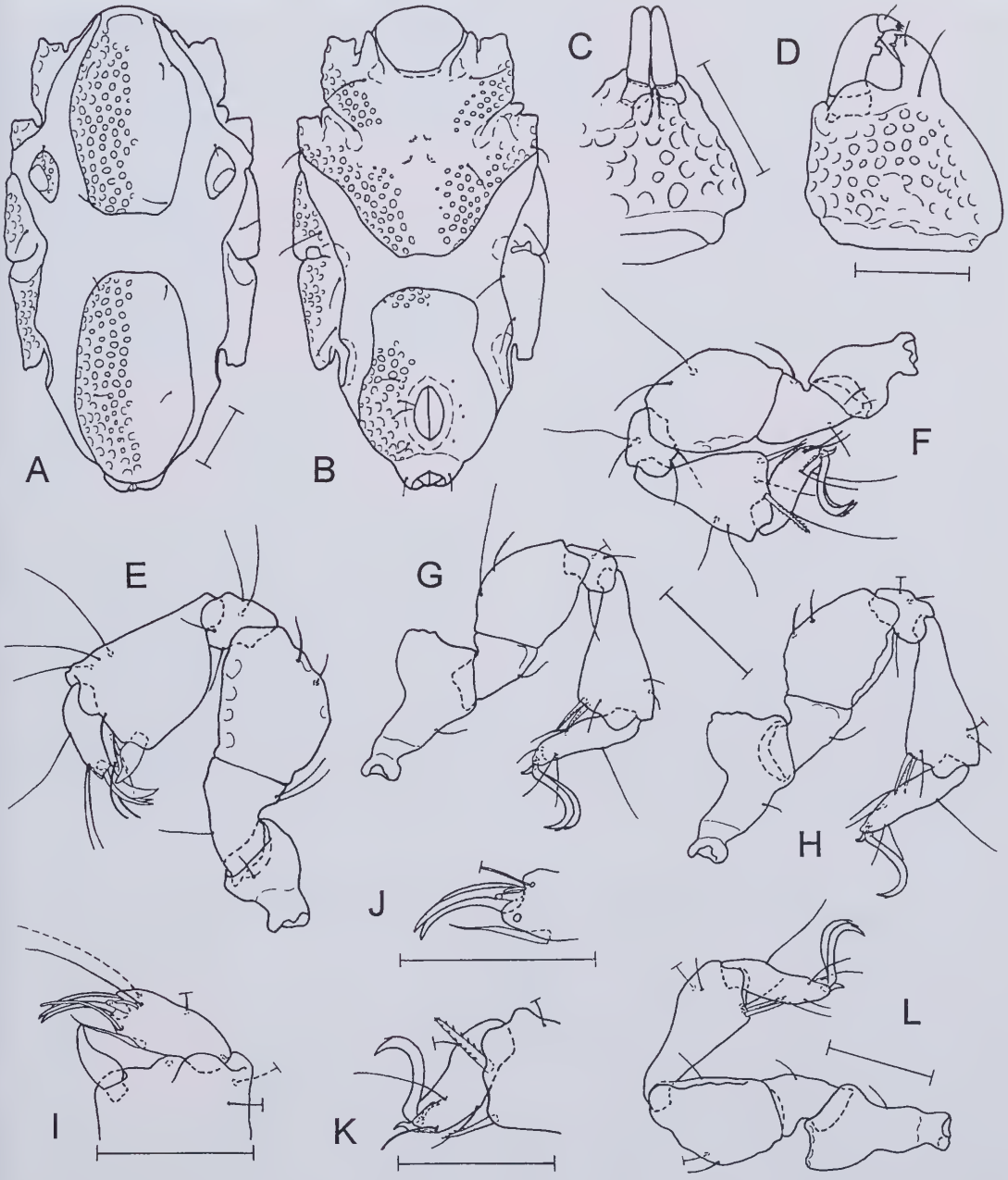

Figure 4 A–L. *Simognathus cruciferus* sp. nov., holotype female. A, Idiosoma, dorsal; B, idiosoma, ventral; C, gnathosoma, dorsal; D, gnathosoma, lateral; E, leg I, medial; F, leg II, medial; G, leg III, lateral; H, leg IV, lateral; I, tarsus and tibia I, lateral (medial parambulacral seta and claw omitted, other medial setae in broken line); J, tip of tarsus I, lateral (parambulacral seta, medial claw and fossary seta omitted), K, tarsus and tibia II, medial (lateral setae omitted); L, leg IV, medial. Scale = 50 µm.

Gnathosoma. Length 97 µm, width 85 µm. Integument of gnathosomal base foveate. Rostrum short. Basal pair of maxillary setae near base of rostrum, apical pair of setae shorter, in posterior third of rostrum (Figure 4D). Tip of rostrum with two pairs of rostral setae. Palps three-segmented; inserted adjacent. In dorsal aspect tectum with median keel, else scale-like and partly obscuring palpal base (Figure 4C). P-2 with ventral protuberance and one bristle-like seta (Figure 4D).

Third segment short, with one basal seta and three short, stout apical setae.

Legs. Integument almost smooth. Length:height ratio of telofemora 1.4. Tibiae club-shaped, length:height ratio of tibiae I and II 1.5, that of tibiae III and IV 2.2 (Figure 4E–H). Tibiae longer than telofemora. Leg chaetotaxy (solenidia excluded, pas included): leg I, 1, 2–3, 2, 4, 5, 6; leg II, 1, 2, 2, 4, 5, 6; legs III and IV, 1, 1, 2, 3, 5, 5. Spine of tibia I wide but short, ending bluntly (Figure 4I). Tibia II with two stout, roughly bipectinate setae (Figure 4K); tibiae III and IV each with pair of bipectinate setae. Tarsus I with tapering ventral seta and pair of pas singlets, three dorsal setae, a short dorsolateral solenidion adjacent to digitiform famulus (Figure 4J). Tarsus II with slender ventral seta, pair of pas singlets, three dorsal setae and a solenidion, 6 µm long, adjacent to short medial fossa membrane (Figure 4K). Tarsi III and IV each with three dorsal setae, single ventral seta, one medial pas, but no lateral pas.

Paired claws of tarsus I rather slender, scythe-shaped, smooth, median claw stout. Paired claws of tarsi II to IV similar in width, claw-shaped with accessory process. Median claw minute.

Abnormality

One of the fourth legs is five-segmented (Figure 4L), its genu is absent, the telofemur bears a ventral seta (which is absent in 'normal' legs), the tibia is somewhat longer than its counterpart.

Etymology

The specific name is derived from *crux* (Latin), a cross, and *ferre* (Latin), to bear, as on the AE the shape of the area with smooth integument resembles a cross.

Remarks

The species belonging to *Simognathus* can roughly be divided into those with distinct, more or less triangular OC and those with the OC reduced to narrow sclerites, *Simognathus cruciferus* is a species with distinct OC. Other easily recognized characters are (1) the ornamentation of the dorsal plates, (2) the ornamentation of the ventral plates, and (3) the absence or presence of a ventral protuberance on P-2 and the insertion of the seta relative to the protuberance. In *S. cruciferus* the dorsal plates are uniformly foveate; a rather narrow cruciform central area of the AE is smooth, its large marginal areas are foveate; P-2 bears a distinct protuberance separated from the seta. With recently described species included (Chatterjee and Chang 2004; Pepato and Tiago 2004; Bartsch 2004, present paper), 44 species are known, 18 of them having the OC reduced to sclerites. In the remaining 26 species, with rather large OC, the AE is either foveate in the margins as well as in the median, or the foveate ornamentation is present only marginally and the integument in a large median area is delicately porose or almost smooth. *Simognathus cruciferus* is at present the only species with smooth integument in a narrow cruciform area.

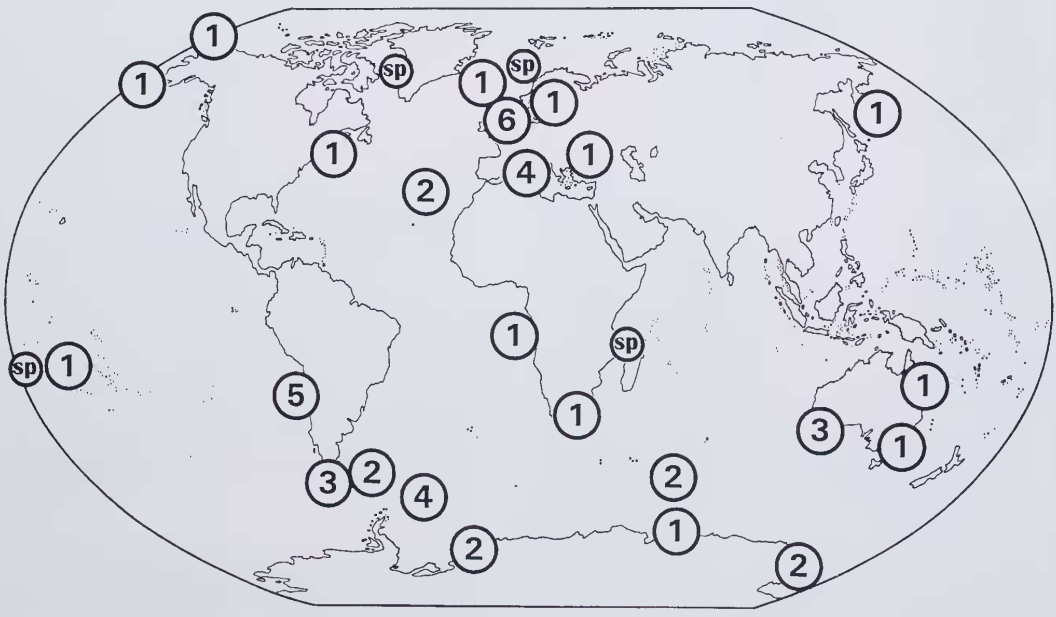

Figure 5 Distribution of the genus *Lohmannella* and number of species in relevant areas.

GEOGRAPHICAL DISTRIBUTION OF THE GENERA *LOHMANNELLA* AND *SIMOGNATHUS*

With the inclusion of the above described species, 36 *Lohmannella* subspecies/species are known (Tables 1 and 2). The genus is spread all over the globe. Apart from marine representatives (Table 1) there are also five freshwater species (Table 2). *Lohmannella* inhabits cavernicolous or mesopsammal habitats, and is present amongst tufts of epiphytic and epilithic algae, corallines or colonies of bryozoans and hydrozoans, coarse sand and rubble. The genus inhabits a depth range from the lower tidal zone to the abyss. The genus seems to be diverse in Antarctic, sub-Antarctic and cold-temperate South American waters and in the Mediterranean and English Channel area (Figure 5). In contrast, a single species is recorded from the north-western Atlantic (Newell 1947; Bartsch 1979b) and one (?) species from the Northern Pacific Ocean, from Alaska, Kamchatka and the Kuril Islands (Newell 1951; Makarova 1977, 1978). The genus seems to be rare in the tropics. One record is from shallow water, viz. *L. dictyota* from the Society Islands and tropical Queensland (Bartsch 1992; Otto 2000). Other species from low latitudes, *L. cygna* Bartsch, 1988, from ca 9°S, 12°E, and *Lohmannella* sp. from 11°S, 47°E, are from depths greater than 400 m (Bartsch 1982, 1988a). There is a predominance of species in the south, with 21 vs 10 marine subspecies/species in the north (Table 1). To the latter figure three more species might be added: the specimens from the depth in the Norwegian Basin, from 64–69°N, 0–10°E (Bartsch 1978), from the Sula coral reef off Norway, 64°N, 8°E (Bartsch 2003a), and an undescribed species from eastern Greenland. The freshwater species are not included.

One very obvious character of *Lohmannella* species is the presence and size of the gland pores. All five pairs may be distinct, often within large alveoli (as described above), or one or more pairs of gland pores are minute, hardly recognizable and hence often not mentioned in species descriptions. All northern Atlantic species have minute or inconspicuous gland pores, whereas many southern shallow water species have pores within large alveoli. In the deep-water species all five pairs of pores are present (although they may be replaced by setulae) but the pores are small. Spiniform processes on the second palpal segment are present in about one-third of southern hemisphere species, in species living in tidal and shallow subtidal coarse sand and rubble. Northern species have four to six bipectinate ventral setae on tibia I, southern species five to eight such setae.

The genus *Simognathus* is distributed in all oceans, in tropical, warm- and cold-temperate and sub-Antarctic biogeographical provinces. Its absence from the Arctic and Antarctic regions may be due to restricted sampling. Records of *Simognathus* are from the low water edge to

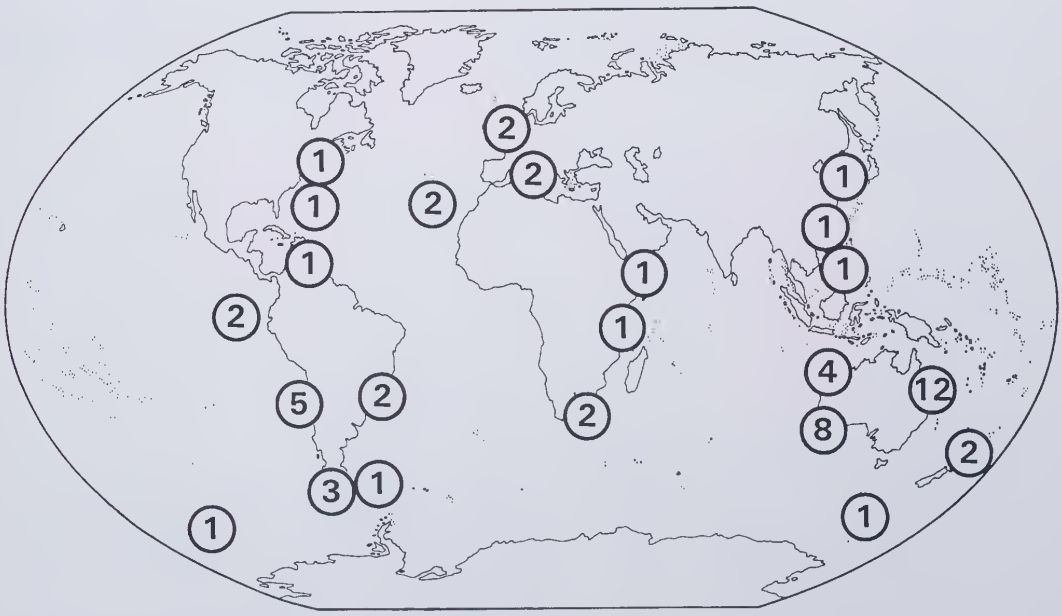

Figure 6 Distribution of the genus *Simognathus* and number of species in relevant areas.

Table 1 The genus *Lohmannella*. List of marine species, morphological characters and collecting data.

species	I	II	III	IV	V	VI	VI	VIII	IX
Northern Hemisphere									
beringi Newell, 1951	?	?	?	?	?	71N, 160W	Arctic	0–39	algae, sand
						52–57N, 173E–170W	Alaska		
						52–55N, 158–166E	Kamchatka		
						47–50N, 152–56E	Kuril Is		
falcata (Hodge, 1863)	a	0	4	6	2	45–65N, 21W–21E	N Europe	0–300	colonial organims,
						41–45N, 67–71W	NE America		algae, sediment,
						42–44N, 3–16E	Mediterranean		
						42–46N, 28–38E	Black Sea		
kervillei (Trouessart, 1894)	a	0	2	6	1	38–53N, 28W–1E	N Europe	tidal	corallines, sand
multisetosa Bartsch, 1986	a	0	2	6	1	43N, 5E	Mediterranean	10–45	sediment
						49–58N, 4W–11E,	N Europe		
norvegica Viets, 1927	a	0	1	6	1	50–60N, 5W–4E,	N Europe	0–sublittoral	
nudipes Bartsch, 1977	a	0	1	5	0	49N, 4W	N Europe	tidal	sediment
rustica Bartsch, 1977	a	0	2	5	1	49N, 4W	N Europe	tidal	crustose corallines
steueri steueri Viets, 1940	a	0	3	5	1–2	45N, 14E	Mediterranean	25–28	shell rubble, algae
steueri reducta Bartsch, 1986	a	0	3	4	0–2	43N, 6E	Mediterranean	20–40	sediment
subfalcata Bartsch, 2003	a	0	3	6	2	30N, 28W	NE Atlantic	318–321	
Southern Hemisphere									
africana Bartsch, 1992	+	1	4	6	1	33S, 28E	South Africa	0	shell rubble
antarctica Newell, 1984	+	0	4	6	2	64S, 64W	Palmer Peninsula	6–460	algae, bryozoans
						66S, 136E	Terre Adélie		
						77S, 166E	Ross Island		
arenaria Bartsch, 1993	+	2	4	6	2	32S, 115E	SW Australia	tidal	coarse sand
bihamata Viets, 1950	+	0	1	6	2	52–54S, 37–58W	Falkland, S. Georgia	shallows	sand, rubble, algae
bispina Newell, 1984	+	2	4	6	1	53S, 72W	Chile	tidal	coarse sand
consimilis Bartsch, 1993	+	0	4	6	2	57S, 27W	S. Sandwich	93–121	
cygna Bartsch, 1988	+	0	5	8	2	9S, 12E	Angola Basin	1430	
dictyota Bartsch, 1992	+	1	2	7–8	2	16S, 152W	Society Islands	tidal–17	coral rubble, coarse sand
						15–19S, 145–151E	NE Australia		
fukushimai Imamura, 1968	(+)s	0	4	7	2	69S, 31E	Prince Harald Coast	190–820	
						72S, 172E	Ross Sea		
						71–74S, 12–29W	Weddell Sea		
gaussi Lohmann, 1907	+	0	4	7	2	65S 92E	Wilhelm II Land	95–385	
						56S, 27W	S. Sandwich		
						47S, 38E	Marion Island		

grandipora Newell, 1984	+	1–2	5	6	1	28–54S, 71–72W	Chile	tidal	coarse shell, sand,
						54S, 37W	S. Georgia		holdfasts
hureaui Newell, 1984	+	0	3	6	?	49S, 70W	Kerguelen	shallows	holdfasts
kerguelensis Lohmann, 1907	+	0	4	7	2	50S, 70E	Kerguelen	shallow–58	
						64S, 61W	Palmer Peninsula		
lamellipes Newell, 1984	+	4–5	?	6	2	53S, 72W	Chile	shallows	holdfasts with sand
masatierrae Newell, 1984	+	0	?	6	?	34S, 79W	Chile	shallows	red algae
multispina Newell, 1984	+	3–4	3	5–6	1–2	18S, 70W	Chile	tidal	shell rubble
pinggi Otto, 1994	+	0	4	7	2	35–38S, 145–150E	S and SE Australia	tidal	
						32S, 115E	SW Australia	tidal	corallines
rectangulops Newell, 1984	+	0	2	5	1	33S, 72W	Chile	tidal	corallines, bivalves
reticulata Viets, 1950	+	0	3–4	6	1	52S, 58W	Falklands	12–16	sand, rubble, algae
septemsetosa sp. nov.	+	0	4	7	2	34S, 122E	SW Australia	low water	sand with algae
setosa Newell, 1984	+	0	3	6	2	26S, 80W	Chile	tidal	corallines

I. Number of gland pores: a, one or more pairs of pores lacking; +, five pairs present; (+)s, one or more of the five pairs replaced by setae.
II. P-2, number of spiniform processes:
III. I-4, number of bipectinate setae:
IV. I-5, number of bipectinate setae:
V. I-6, number of bipectinate setae:
VI. Collecting area, coordinates:
VII. Collecting area, state/province/island or sea area:
VIII. Depth (in m):
IX. Habitat:

Table 2 Freshwater *Lohmannella* species and collecting data.

species	country	salinity
andrei (Angelier, 1951)	France	fresh
curvimandibulata (Petrova, 1966)	Bulgaria	fresh
cvetkovi (Petrova, 1965)	Bulgaria	fresh
heptapegoni Petrova, 1966	Israel	fresh
stammeri Viets, 1939	Italy, Monte Negro	fresh, slightly brackish

Table 3 The genus *Simognathus*. List of species, morphological characters and collecting data.

species	I	II	III	IV	V	VI	VI	VIII	IX
Northern Hemisphere (5–90N)									
adriaticus Viets, 1940	la	p+s	sl	?	?	45N, 14E	Mediterranean	0.5–3	algae
coreensis Chatterjee and Chang, 2004	la	p/s	sl	1+1?	1+1?	36N, 135E	Korea		intertidal corallines
foveolatus Bartsch, 1991	la	p/s	sl	1+1	1+1	22N, 115E	S China	low water	coarse sand
fuscus Viets, 1936	la	p/s	sl	1+1	1+1	12–32N, 65–68W	Bermuda, Caribbean	0–11	rubble, algae
leiomerus Trouessart, 1894	re	p+s	sl	1+2	2+2	49–54N, 2–6W 43N, 3-5E	N Europe Mediterranean	0–13	sediment, algae
minor Bartsch, 1979	re	p+s	sl	1+2	2+2	41N, 71W	E USA	tidal	sand
minutus (Hodge, 1863)	la	p/s	sl	1+1	1+1	47–60N, 10W–12E*	N Europe	tidal–65	sand, algae
serratus Bartsch, 2004	la	p/s	sl	1+1	1+1	29–30N, 28W	Great Meteor Bank	476–511	
Equator (5N–5S)									
disparilis Bartsch, 1977	re	p/s	sl	1+2	1+2	0, 90W	Galapagos	tidal	sand
similis Bartsch, 1977	la	p+s	sl	1+1	1+1	0, 90W	Galapagos	tidal	sand
tropicalis Chatterjee and de Troch, 2000	re	p/s	?	1+?	1+?	4S, 20E	Kenya	low water	seagrass
Southern Hemisphere (5–80S)									
abnormalus Otto, 2000	re	s	sl	1+1	1+1	16–19S, 145–150E	NE Australia	0–15	coarse sand, rubble
actius Otto, 2000	re	p/s	pe	1+1	1+1	16–19S, 145–147E	NE Australia	tidal	sand
areolatus Newell, 1984	la	p/s	sl	?	?	18–53S, 70–72W	Chile	tidal	sand, colonial organisms, algae, holdfasts
aspidiotus Otto, 2000	re	p/s-p	sl	1+1	1+2	15–19S, 145–152E	NE Australia	0–15	coarse sand, coral rubble
clypeatus Otto, 2000	re	p/s	?	1+2	1+2(d)	17S, 149W	NE Australia	5–15	coarse sand
corneatus Otto, 2000	la	p/s	sl	1+1	1+1	19S, 147–149E	NE Australia	3–15	coarse sand, rubble
coutieri (Trouessart, 1899)	re	p/s	?	?	?	12S, 43E	Djibouti	low water	shell and coral rubble
cruciferus sp. nov.	la	p/s	sl	1+1	1+1	34S, 122E	SW Australia	low water	demosponge with small algae
delicatulus Bartsch, 1994	re	p/s	sl	1+1	1+1	32S, 115E	SW Australia	tidal	sand
exoticus Otto, 2000	la	p/s	sl	1+1	1+1	17–18S, 148–152E	NE Australia	5–7	sand
euphractus Pepato and Tiago, 2004	la	p+s	sl?	1+1	1+1	24S, 45W	Brazil	tidal	rocky shore
fuscus Viets, 1936	la	p/s	sl	1+1	1+1	24S, 45W	Brazil	tidal	rocky shore
gibberosus Bartsch, 1994	la	s	sl	1+1	1+1	32S, 115E	SW Australia	low water	sand, corallines
glaber Bartsch, 1986	la	p/s	sl	1+2	?	36S, 175E	New Zealand	tidal	corallines
glareus Bartsch, 1986	la	p/s	sl	1+1	1+1	36S, 175E 35S, 19E	New Zealand South Africa	tidal	gravel

gracilis Bartsch, 1994	re	s	sl	1+1	1+1	32S, 115E	SW Australia	30	medium to coarse sand
hulingsi Newell, 1984	la	p+s?	sl	'?	?	18–53S, 70–72W	Chile	tidal-shallows	worm tubes, holdfasts
latitarsus Proches, 2002	la	p+s?	w	1+2	1+2?	30S, 30E	South Africa	tidal	algae
maculatus Bartsch, 1994	la	p/s	sl	1+1	1+1	32S, 115E	SW Australia	0.5	seagrasses
magellanicus Newell, 1984	la	p/s	sl	?	?	53–55S, 71W	Chile	tidal–278	algae, corallines, holdfasts, barnacles
						52S, 58W	Falklands		
						54S, 159W		88–278	
						55S, 159E	Macquarie Ridge	92–113	
obtusus Newell, 1971	la	p/s	sl	?	?	26–33S, 72–80W	Chile	tidal–190	corallines, mussels, coarse sand
pectinatus Newell, 1984	re	p+s?	sl	?	?	17–27S, 70-71W	Chile	tidal	shell fragments, worm tubes
platyaspis Otto, 2000	la	p/s	sl	1+1	1+1	15–28S,145–147E	NE Australia	0–6	sand, rubble, coral fragments
						21S, 117E	NW Australia	low water	coral block
						10S, 124E	Philippines	10–15	sand and algae
pygmaeus Otto, 2000	re	s	sl	1+2	1+2	16S, 145E	NE Australia	tidal	sand
salebrosus Bartsch, 2003	re	s	sl	1+1	1+1	21S, 117E	NW Australia	tidal	sand
scutatus Bartsch, 1993	re	s	sl	1+1	1+1	32S, 115E	SW Australia	tidal	coarse sand
specialis Otto, 2000	la	p/s	sl	1+1	1+1	15–18S, 147–150E	NE Australia	0.5–15	algae, coarse sand, coral rubble
subobtusus Newell, 1984	la	p/s	sl	?	?	34S, 79W	Chile	tidal	algae
tener Bartsch, 2003	re	p/s	sl	1+2	1+2	21S, 117E	NW Australia	tidal	coarse sand
trachys Otto, 2000	la	s	sp	1+1	1+1	19S, 149E	NE Australia	10	coarse sand, coral rubble
uniscutatus Bartsch, 1994	re	p/s+p	sl	1+1	1+1	32S, 115E	SW Australia	2–13	sand
						21S, 116E	NW Australia		
variolosus Bartsch, 1994	re	s	sl	1+2	1+2	32S, 115E	SW Australia	tidal	sand
versicolor Otto, 2000	la	p/s	sl	1+1	1+1	19S, 149E	NE Australia	10	coral rubble
xandarus Otto, 2000	la	p/s	sl	1+1	1+1	19–22S, 147–153E	NE Australia	3–15	medium to coarse sand

I. Shape of OC: re, reduced; la, large, triangular or rounded.
II. P-2: p/s, with protuberance and distal seta; p/s-p, with protuberance and distal seta and a small distal protuberance; p+s, protuberance and seta at same level; s, seta only, protuberance lacking.
III. I-5, shape of ventromedial seta: pe, bipectinate; sl, slender; sp, spiniform; w, wide though setiform.
IV. III-6, number of ventral and parambulacral setae: 1+1, either one ventral and one parambulacral seta or two ventral setae and parambulacral setae lacking; 1+ 2, one ventral seta and pair of parambulacral setae; 1+2(d), one ventral seta and pair of parambulacral setae, one of pas doubled; 2+2, two ventral and pair of parambulacral setae.
V. IV-6, number of ventral and parambulacral setae: character states as above.
VI. Collecting area, coordinates:
VII. Collecting area, state/province/island or sea area:
VIII. Depth (in m):
IX. Habitat:
*, doubtful records excluded; ?, information lacking or in need of confirmation.

bathyal (0–500 m). Representatives of the genus inhabit coarse sand, rubble, crustose and other algae, seagrasses, colonies of polychaetes and barnacles. There is a strikingly high diversity in the Australian fauna (Figure 6), 12 species being recorded from Queensland and 10 species from Western Australia. Though knowledge of the halacarid fauna of New Zealand is meagre, two of the 23 marine species recorded are representatives of *Simognathus*. From the southern South American continent six *Simognathus* species are recorded (Newell, 1984). Almost 70 marine halacarid species are known in total (Newell 1984; Bartsch 1988b, 1989). In contrast, only two out of 90 species in the Mediterranean, and two out of the known 120 shallow water halacarid species in the northeastern Atlantic, belong to the genus *Simognathus*. From eastern North America there is just a single record (Bartsch 1979b).

Table 3 presents a list of *Simognathus* species, their geographical areas and habitats, and some of their morphological characters. *Simognathus* species can roughly be divided into those with large OC, round or triangular in shape, and those with the OC reduced to narrow sclerites which often are obscured by the striated integument. Other characters are the shape of P-2, with or without any protuberance, and the number and arrangement of tarsal setae. Both in the north and south there are species with reduced OC, and the reduction seems to be correlated with a mesopsammal life style. Palps with the seta of P-2 and the protuberance situated at the same level are present in northern as well as in southern species. According to the setation of tarsi III and IV, *S. leiomerus* and *S. minor* are closely related. Other siblings are *S. abnormalus* and *S. salebrosus*; they share the characters: tibia I widest near its base, tarsus I very short and rotated versus the leg's axis, and presence of epimeral fossae. These characters are absent in other species.

Looking at the present day distributional records, one may expect *Simognathus* to be a Gondwanan genus with several founder species dispersing to the European, North American and Asian coastlines. More detailed analysis is necessary to eluciate these patterns.

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